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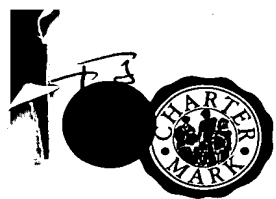
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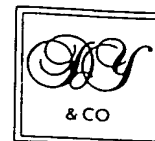
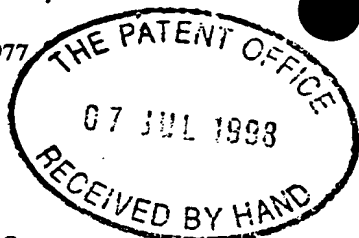
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08JUL98 E374023-17 D02246  
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3. Full name, address and postcode of the or of each applicant  
(underline all surnames)

ROBERT JOHN WATTS  
Venards Cottage  
North Gorley  
Fordingbridge  
Hampshire  
SP6 2PJ

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

7304512001

4. Title of the invention

ANKLE-FOOT ORTHOSIS

5. Name of your agent (if you have one)

D YOUNG & CO

"Address for service" in the United Kingdom to which all correspondence should be sent  
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21 NEW FETTER LANE  
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EC4A 1DA

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59006

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6. If you are declaring priority from one or more earlier patent applications, give the country and date of filing of the or each of these earlier applications and (if you know it) the or each application number

Country

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9721863.0

15.10.97

7. If this application is divided or otherwise derived from an earlier UK application, give the number and filing date of the earlier application

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? **No**  
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a) any applicant named in part 3 is named inventor, or  
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Description **6**

Claims(s) **2**

Abstract **1**

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Priority documents **Form 23/77 filed herewith**

Translations of priority documents **none**

Statement of inventorship and right to grant of a patent (Patents Form 7/77) **none**

Request for preliminary examination and search (Patents Form 9/77) **one (1)**

Request for substantive examination (Patents Form 10/77) **none**

Any other documents **none**  
(please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature

Date

**D Young + Co.**

**07.07.98**

**D YOUNG & CO**  
**Agents for the Applicants**

12. Name and daytime telephone number of the person to contact in the United Kingdom

**Michael Purvis**

**01703 634816**

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ANKLE-FOOT ORTHOSIS

This invention relates to ankle-foot orthoses.

5       Orthoses are mechanical devices which impose forces upon a limb of a patient and can be used for a variety of different purposes. For example, orthoses may be provided for supportive, functional, corrective or protective purposes, or for a combination of these. Ankle-foot orthoses are typically provided to provide protection to the ankle and foot of a patient as well as to provide support against excessive  
10       plantarflexion or dropping of the foot. In addition to this resistive function, they may also be employed to assist dorsiflexion of the patient's foot during the push off phase of the patient's gait. Orthoses may also be employed to resist plantarflexion caused, for example, by the weight of bedcoverings or the like on a patient's feet during extended periods of bedrest.

15       Foot plantarflexion is a medical condition that can arise from a variety of causes, for example disease or congenital abnormality. Patients affected by this condition typically experience difficulty in walking as they must lift their foot excessively from the ground in order to avoid stumbling.

20       A variety of different ankle-foot orthoses have previously been proposed for resisting plantarflexion, and in some cases for additionally assisting dorsiflexion. Figures 1a, 1b, 2a and 2b illustrate two of these previously proposed devices.

25       Figure 1a illustrates one previously proposed ankle-foot orthosis before it is assembled on a patient. The orthosis 10 must be used in conjunction with a shoe 12 that provides close contact between the shoe and the foot in the region of the instep. The orthosis 10 comprises a pair of supporting metal uprights 14, one connected to either side of the shoe 12 in the region of the heel 16. The connections each comprise  
30       a plantarflexion stop 18 that resists foot drop and may also include springs (not shown) to assist dorsiflexion. The upper ends of the uprights are connected to a

supporting strap 20 which is securable about the patient's calf. With reference to Figure 1b, it can be seen that the supporting strap 20 provides support about the patient's calf, and that the plantarflexion stops 18 and shoe 12 provide support under the foot of the patient to resist plantarflexion.

5

Figures 2a and 2b illustrate another previously proposed orthosis device which must also be used in conjunction with a shoe that provides close contact between the shoe and the foot in the region of the instep. In this example, the orthosis 22 comprises a one-piece plastics moulding 24 which comprises a calf abutting region 26 and a sole abutting region 28. The top of the calf abutting region 26 is provided with a closure mechanism 27 that enables the device to be secured to the calf of a patient. The sole abutting region 28 acts in conjunction with the shoe 30 to support the foot of the patient. The stiffness of the plastics moulding and the shape thereof in the region of the ankle defines the amount of resistance to plantarflexion. If more resistance is required, then the gap across the front of the ankle can be reduced, or the stiffness of the plastics can be increased.

10

15

Both of the aforementioned previously proposed devices adequately support the foot of a patient to resist plantarflexion. However, they both exhibit serious deficiencies that make them highly unpopular with patients.

20

A first disadvantage is that both of the previously proposed orthoses are large bulky devices which are clearly visible when worn. Thus, the patient's illness or abnormality is immediately apparent to others and this can adversely affect the patient's state of mind. This problem can be particularly apparent with child patients as the orthosis is an immediately obvious difference which other children can ridicule. It can also be a serious problem for adult patients as a visible device immediately labels them as a disabled or abnormal person with corresponding ramifications for their personal and working lives.

25

30

A further disadvantage is that both of these previously proposed devices must



be worn with shoes. Thus, if a patient wished to walk without shoes or to go swimming, for example, then they would have to do so without any means for resisting plantarflexion.

5       A further disadvantage is that these previously proposed devices can cause extreme discomfort when worn. This problem is particularly apparent with the orthosis of Figures 2a and 2b as the device extends under the foot of the patient and thus the full weight of the patient bears upon the device when the patient walks.

10       Yet another disadvantage is that both of these previously proposed devices are difficult and time consuming to put on and take off. Furthermore, the second device often requires the fabrication of special shoes as it is often not possible to fit the device within normal off-the-shelf shoes. Finally, both devices are expensive to make and fit as they must be closely fitted to the feet and legs of the patient, and as they  
15       are made from relatively expensive materials.

It is an object of aspects of the invention to alleviate some or all of these disadvantages.

20       In accordance with an aspect of the invention, there is provided an ankle-foot orthosis for resisting plantarflexion of a patient's foot, the orthosis comprising: a resilient rib locatable, in use, along and in abutment with at least a portion of the dorsal aspect of the patient's foot and at least a portion of the patient's lower leg, the orthosis comprising means for securing the rib to the patient's foot and lower leg.

25       In one embodiment, the securing means comprises a first strap means securable about one end of the rib and the patient's lower leg, and a second strap means securable about the other end of the rib and the patient's foot.

30       In another embodiment, the securing means comprises a first strap means securable about one end of the rib and the patient's lower leg and a shoe for securing

the other end of the rib to the patient's foot.

In another embodiment, the securing means comprises an adhesive, at least end portions of the rib being adhered to the patient's lower leg and foot.

5

In any event, it is preferred that the rib is of plastics, such as polypropylene or ortholene.

Preferably, the orthosis is skin coloured and/or fabricated by injection  
10 moulding. The orthosis could be formed by stamping from sheet material. The orthosis could alternatively be brightly coloured so as to appeal to children.

In accordance with a second aspect of the invention, there is provided a kit comprising a plurality of orthoses as described herein, the orthoses being of varying  
15 size and shape for fitting to feet of different sizes and shapes. The kit may also comprise differently coloured orthoses to allow the matching of the colour of the orthosis to the skin colour of the patient.

Embodiments of the present invention will now be described, by way of  
20 example only, with reference to the accompanying drawings, in which:

Figures 1a and 1b are schematic representations of one previously proposed orthosis;

Figures 2a and 2b are schematic representations of another previously proposed orthosis;

25 Figure 3 is a schematic representation of an orthosis according to a first aspect of the invention;

Figure 4 is a side view of the orthosis of Figure 3; and

Figure 5 is a schematic representation of an orthosis according to a second aspect of the invention.

30

Figure 3 is a schematic representation of an orthosis 1 that comprises a resilient

rib 3 that is locatable in use along the dorsal aspect of the patient's foot 5. As shown, the orthosis 1 extends from approximately the base of the patient's toes up to the lower portion of the patient's shin.

5       The rib 3 is formed of a material that is preferably relatively light-weight and resilient - such as a plastic. A preferred material is ortholene or polypropylene, but numerous other suitable materials (such as a metal, an alloy or carbon fibre or similar material for example) will be apparent to persons skilled in the art. The orthosis could be injection moulded, or for a more precise fit could be individually fitted to a  
10       patient's foot.

In order for the orthosis to benefit the patient, it must somehow be secured to the patient's foot. In the embodiment of Figure 3, the orthosis 1 is secured to the foot 5 by way of a pair of straps 7, which in the preferred embodiment include mechanical  
15       hook-and-loop fasteners (not shown) such as velcro<sup>R</sup> that enable the straps 7 to be secured around the patients foot and lower leg respectively. Alternative fastening mechanisms, such as pop fasteners, could be provided in addition or instead of velcro<sup>R</sup>. When the straps are secured about the patient's foot and lower leg, the orthosis 1 is secured to the patient's foot and plantarflexion is resisted. The arrangement of Figure  
20       3 is particularly advantageous for use in warmer climates as the majority of the patient's foot is not covered by the orthosis 1.

Figure 4 is a side view of the orthosis 1 of Figure 3 illustrating the points at which pressure is applied to the patient's foot by the device. As shown, the orthosis  
25       1 applies pressure to the patient's foot at three discrete locations (i), (ii) and (iii). Application of pressure to the foot at these three locations causes plantarflexion to be resisted whilst also aiding dorsiflexion. In this way, the orthosis 1 aids the patient during all stages of the walking motion. Furthermore, the orthosis 1 shown is considerably more comfortable for the patient to wear than previously proposed  
30       devices as it does not extend beneath the foot and thus the weight of the patient does not bear upon the orthosis 1 during walking.

A second embodiment of the invention is shown in Figure 5. This embodiment of the invention is primarily designed for use in conjunction with a shoe 9, and comprises an orthosis 1 of polypropylene, for example, and a single strap 11 provided at the end of the reinforcing means closest to the patient's leg, in use. Securing the strap 11 around the patient's lower leg and inserting the foot 5 and orthosis 1 within a shoe 9 provides an orthosis that is capable of resisting plantarflexion of the patient's foot. As an alternative to providing a strap, the upper end of the orthosis could be adhered to the patients lower leg.

10 If the straps of the orthosis of Figure 3 are removably attached to the rib 3, then the orthosis of Figure 3 could be converted for use with a shoe, as shown in Figure 5, simply by removing the lower strap.

As a further alternative that is not illustrated in the drawings, the straps could be dispensed with and the rib could then be adhered at least at the ends thereof to the Patient's lower leg and foot. The adhesive could be any adhesive suitable for bonding articles to skin.

The orthosis of either embodiment may be coloured so that it can be matched to the skin colour of the patient, and may be provided in a variety of different shapes and sizes.

The orthosis may be of a variety of different materials chosen to have a suitable resilience. For example, the orthosis could be of rubber, silicone, plastics, carbon fibre or of any other material apparent to persons skilled in the art. In a preferred example, the orthosis is of 35 shore silicone elastomer. The orthosis may be of a greater or lesser shore value depending upon the particular needs of the patient to which it is to be fitted.

30 It will be understood that the invention has been described herein by way of example only and that modifications may be made within the scope of the invention.

CLAIMS

1. An ankle-foot orthosis for resisting plantarflexion of a patient's foot, the orthosis comprising: a resilient rib locatable, in use, along and in abutment with at  
5 least a portion of the dorsal aspect of the patient's foot and at least a portion of the patient's lower leg, the orthosis comprising means for securing the rib to the patient's foot and lower leg.
2. An orthosis according to Claim 1, wherein the securing means comprises a first  
10 strap means securable about one end of the rib and the patient's lower leg, and a second strap means securable about the other end of the rib and the patient's foot.
3. An orthosis according to Claim 1, wherein the securing means comprises a first  
15 strap means securable about one end of the rib and the patient's lower leg and a shoe for securing the other end of the rib to the patient's foot.
4. An orthosis according to Claim 1, wherein the securing means comprises an  
20 adhesive, at least end portions of the rib being adhered to the patient's lower leg and foot.
5. An orthosis according to any of Claims 1 to 4, wherein the rib is of plastics.
6. An orthosis according to any of Claims 1 to 4, wherein the rib is of silicone.
- 25 7. An orthosis according to any of Claims 1 to 5, wherein the rib is of polypropylene.
8. An orthosis according to any of Claims 1 to 5, wherein the rib is of ortholene.
- 30 9. An orthosis according to any of Claims 1 to 4, wherein the rib is of carbon fibre.

10. An orthosis according to any preceding claim, wherein the orthosis is skin coloured.
11. An orthosis according to any preceding claim, wherein the orthosis is fabricated by injection moulding.
12. An orthosis according to any of Claims 1 to 10, wherein the orthosis is stamped or pressed from sheet material.
- 10 13. A kit comprising a plurality of orthoses according to any preceding claim, the orthoses being of varying size and shape for fitting to feet of different sizes and shapes.
14. A kit according to Claim 13, comprising differently coloured orthoses to allow the matching of the colour of the orthosis to the skin colour of the patient.
- 15 15. An orthosis substantially as hereinbefore described with reference to Figures 3, 4 and 5 of the accompanying figures.
- 20 16. A kit substantially as hereinbefore described.

ABSTRACTANKLE-FOOT ORTHOSIS

5

An ankle-foot orthosis 1 for resisting plantarflexion of a patient's foot 5, the  
 orthosis ~~comprising~~ <sup>consisting of</sup> a resilient rib 3 locatable, in use, along and in abutment with at  
 least a portion of the dorsal aspect of the patient's foot 5 and ~~at least~~ a portion of the  
 patient's lower leg, <sup>and</sup> ~~the orthosis comprising means~~ <sup>for securing the rib 3 to the</sup>  
 10 patient's foot and lower leg. <sup>such as two straps 7, a strap and a shoe (fig. 5, 11 and 9)</sup>  
<sup>or adhesive</sup>

FIGURE 3

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FIGURE 1a

1/2

FIGURE 1b

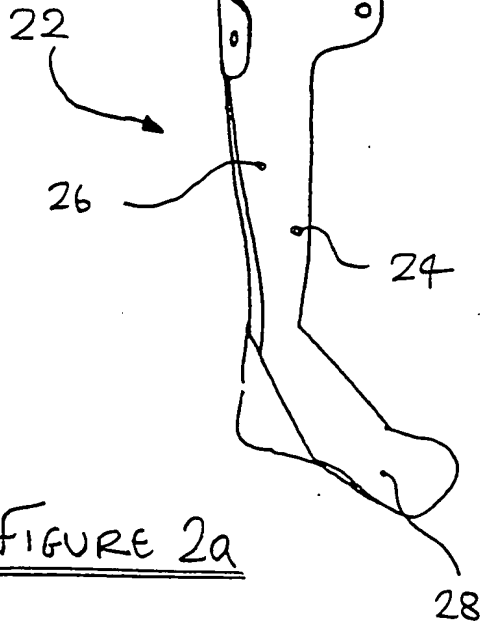
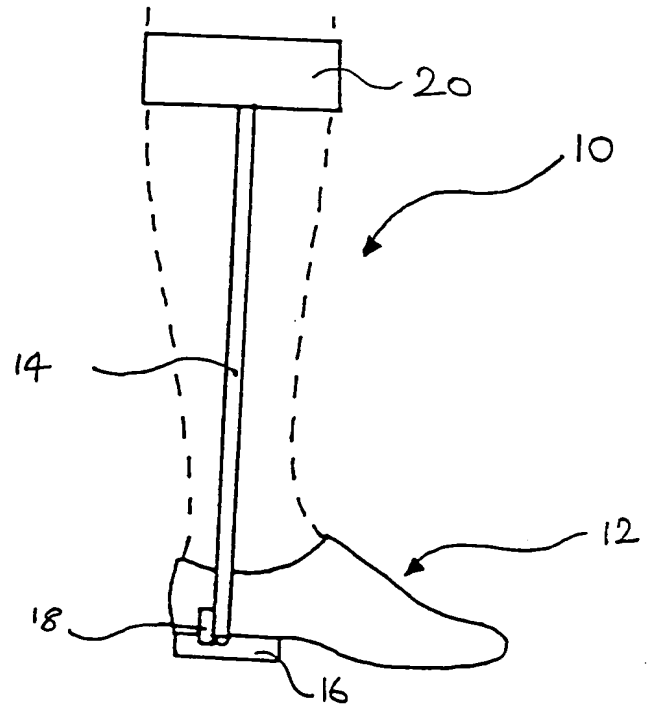
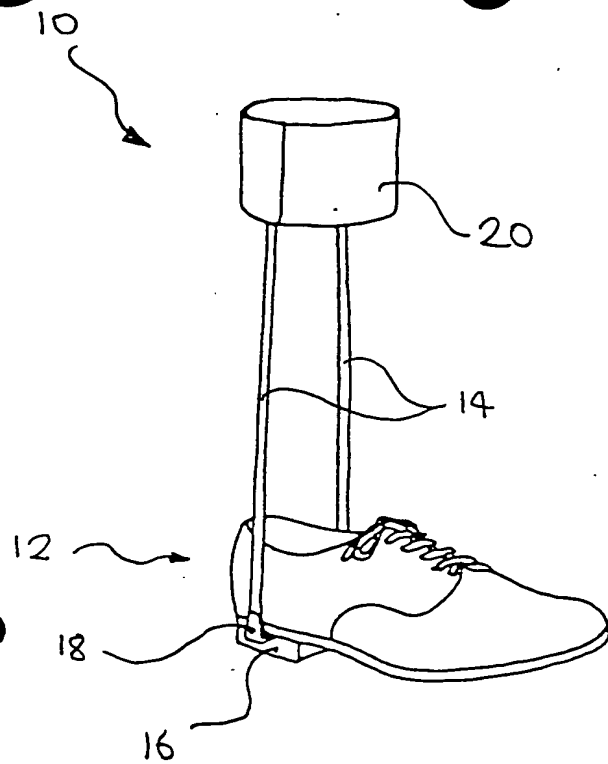


FIGURE 2a

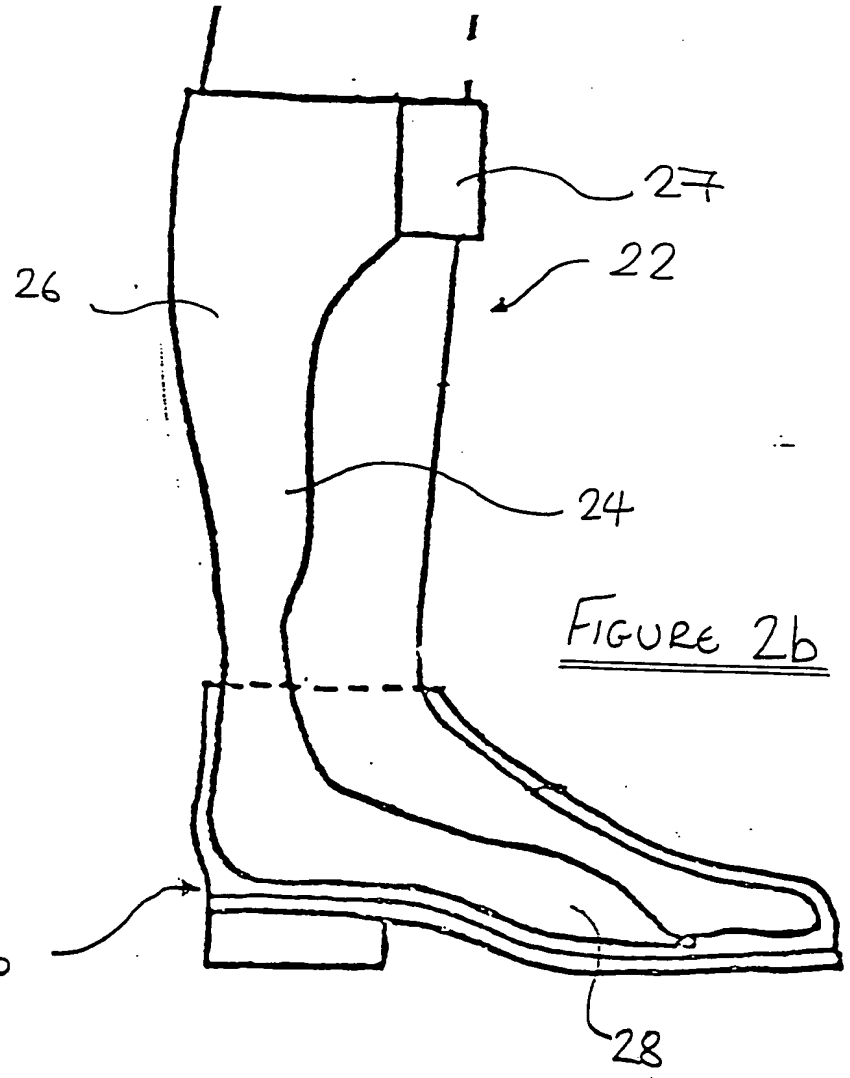


FIGURE 2b

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FIGURE 5

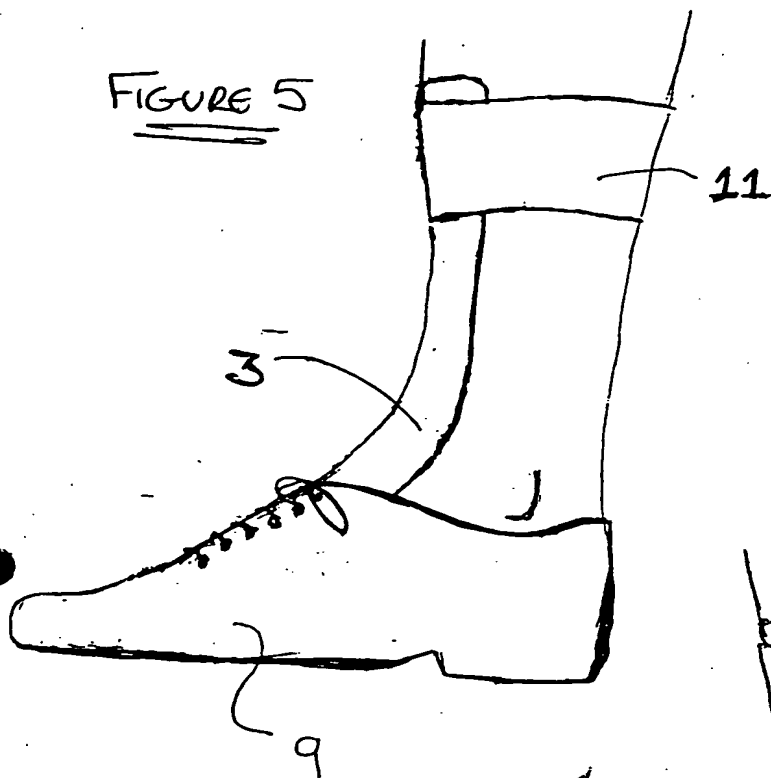


FIGURE 3

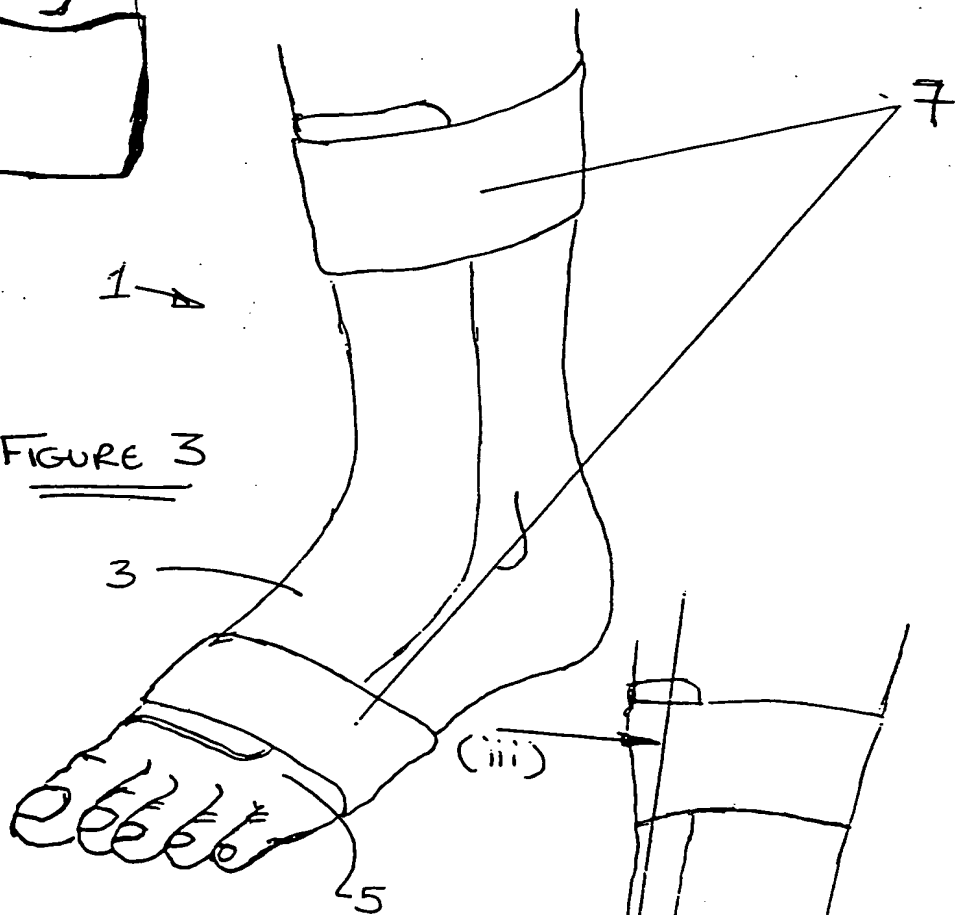
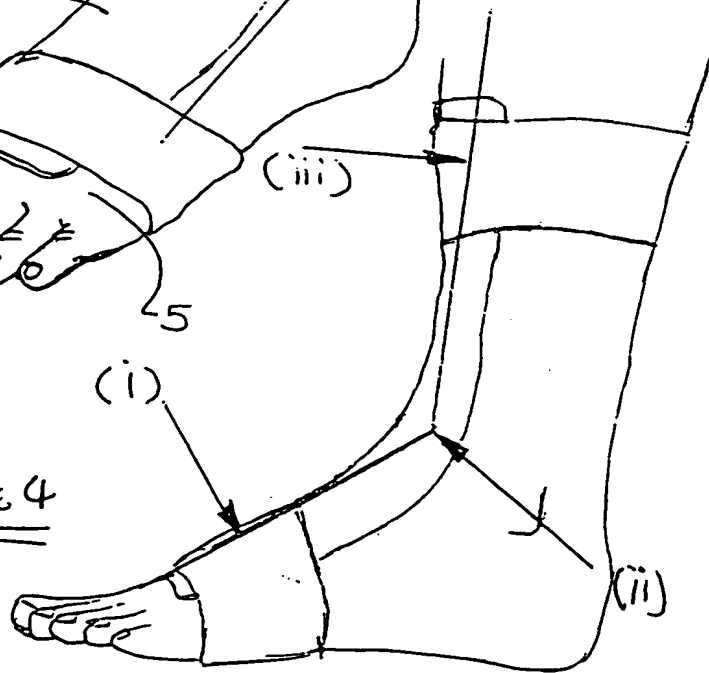


FIGURE 4



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